KERATINOPHILIC FUNGI IN MUD OF IBRAHIMIA CANAL, EGYPT

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ABSTRACT - The composition and frequency of occurrence of keratinophilic fungi in 20 mud samples collected from different sites of edge of Ibrahimia canal and baited with human hair at 28°C was determined. 44 species which belong to 21 genera were collected. Several keratinophilic fungi were isolated, but with different frequency and these were *Chrysosporium indicum, C. tropicum, C. keratinophilum, C. queenslandicum, C. pannorum, C. inops, C. pannicola, C. dermatitidis, Microsporum boullardii, M. gypseum, M. racemosum, Trichophyton ajelloi, T. terrestre, T. mentagrophytes, Candida albicans, Arthroderma tuberculata* and *Allescheria boydii*. Other saprophytic and cycloheximide resistant fungi were isolated.

RÉSUMÉ - Composition et fréquence d'apparition de champignons kératinophiles dans 20 échantillons de boue, récoltés sur les bords du canal Ibrahimia (Egypte). Parmi les 44 espèces (21 genres) isolées: *Chrysosporium indicum, C. tropicum, C. keratinophilum, C. queenslandicum, C. pannorum, C. inops, C. pannicola, C. dermatitidis, Microsporum boullardii, M. gypseum, M. racemosum, Trichophyton ajelloi, T. terrestre, T. mentagrophytes, Candida albicans, Arthroderma tuberculata* et *Allescheria boydii*.

KEY WORDS : Keratinophilic fungi, cycloheximide resistant fungi, mud-borne fungi.

INTRODUCTION

Keratinophilic fungi are of importance and considerable significance and several investigations have been made on the contribution of these fungi in soils and different substrates from many parts all over the world (Ajello & Ziedberg, 1951; Ajello, 1952, 1954; Ajello & al., 1964; Randhawa & Sandhu, 1965; Ajello & Padhye, 1974; Caretta & Piontelli, 1975; Calvo & al., 1984; Della Franca & Caretta, 1984; Mangiarotti & Caretta, 1984; Abdel-Hafez, 1987). In Egypt, few surveys were carried out on keratinophilic fungi from soil (Abdel-Fattah & al., 1982) and hair of some animals (Bagy & Abdel-Hafez, 1985; Bagy, 1986). The present investigation aimed to study intensively the composition and frequency of occurrence of keratinophilic fungi in mud of Ibrahimia canal.

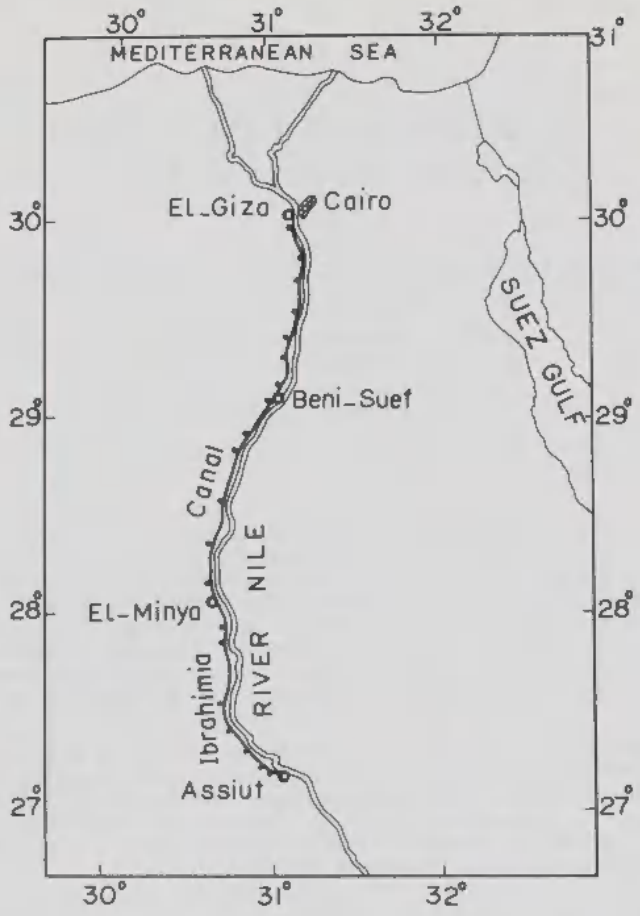

Fig. 1 - Outline map showing the Ibrahimia canal from which mud samples (•) were collected.

Fig. 1 - Récoltes des échantillons (•) le long du canal Ibrahimia.

MATERIALS AND METHODS

Twenty mud samples, about 1kg each, were collected from different sites of edge of Ibrahimia canal (about 370km long) as shown in figure 1.

The mud samples were analysed chemically for the estimation of organic matter and total soluble salts contents. A pH-meter was used for the determination of mud pH. The moisture contents of mud samples was estimated. The mud type was determined by the hydrometer method as

described by Piper (1955) and the samples tested were clay (12 samples), clay-loam (5 samples) and clay-sandy (3 samples).

Determination of keratinophilic fungi

The hair baiting technique was used as reported by Vanbreuseghem (1952) and employed by Abdel-Fattah & al. (1982). Fifty grammes of mud (based on dry weight) samples were put in a sterile plate (5 plates were used for each sample). The moisture contents of mud samples were adjusted to the desired moisture contents (about 30%) by adding the required amount of sterile distilled water to the mud in Petri-dishes and mixed thouroughly. Pieces of sterile human hair were sprinkled on the surface of mud. The plates were incubated at 28°C for 10-12 weeks. The moulds which appeared on the baits were transferred to the surface of Sabouraud's dextrose agar medium (Moss & Mc Quown, 1969) which was supplemented with 20 units/ml of sodium penicillin, 40μg/ml of dihydrostreptomycin and 0.05% cycloheximide (Actidione). The agar plates and slants were incubated at 28°C for 3-4 weeks and the developing fungi were examined and identified.

RESULTS AND DISCUSSION

The mud samples tested were generally poor in organic matter (0.6-2.3% of dry mud) and total soluble salts contents (0.1-1.1%). The pH values of mud samples were all in the alkaline side. This is in agreement with the results of Egyptian cultivated soils previously examined by Moubasher & Abdel-Hafez (1978). The moisture contents of mud samples were very high and ranged between 23.5-28.3%.

Forty-four species which belong to 21 genera were collected from the 20 mud samples baited with human hair (Tab. 1).

Chrysosporium was the most common genus in mud samples baited with human hair, occurring in 80% of the samples. It was represented by 9 species of which *C. indicum*, *C. tropicum* and *C. keratinophilum* were the most prevalent, these were encountered in 70, 45 and 35% of the samples respectively. The above species were recovered in 27.1, 18.5 and 10% of soil samples baited with human hair and examined by Abdel-Fattah & al. (1982). *C. queenslandicum*, *C. pannorum*, *C. inops*, *C. parvum*, *C. pannicola* and *C. dermatitidis* were less frequent in mud samples. These species were encountered, but with different frequency of occurrence, from hairs of camel and goat in Egypt (Bagy & Abdel-Hafez, 1985), as well as from hairs of goat and sheep (Abdel-Hafez, 1987). These species had been previously isolated but with different frequencies from soils of many parts of the world (Randhawa & Sandhu, 1965; Ajello & Alpert, 1972; Jana & al., 1979; Mc Aleer, 1980; Calvo & al., 1984). Most members of *Chrysosporium* were originally observed in most soils and on the dung of various animals and leather, but

have also been frequently isolated from bird habitats, bird's feathers and bird's nests (Domsch & al., 1980).

Microsporum was the second most common genus and was emerged in 70% of the samples. From the genus, 3 species were collected of which *M. boullardii* was the most prevalent; *M. gypseum* and *M. racemosum* were less common. Abdel-Fattah & al. (1982) isolated *M. gypseum* from Egyptian soils, it was encountered in 8.5, 2.9 and 7.1% of the soil samples baited with human hair, animal hair and feathers, respectively. This species is cosmopolitan. It was encountered from 10.2% of soil specimens from the USSR (Stepanishcheva, 1965); from 25.7 and 11.75% of soil and water samples in Tashkent (Belukha & Luk'yanova, 1969); from 13.7% from marine soils in Bombay (India) where sea water carried keratinaceous substrates from neighboring village (Padhye & al., 1967); from 4.38% of the soil from German Federal Republic (Meinhof & Grabowski, 1972); and from 31% of soils from Tehran, Iran (Alilous & Asgar, 1973). It has also been reported from skin lesions, feathers and pellets of free-living birds, the hair and skin of monkeys, dogs, mice, rats and other small mammals. It has been recognized as the causal agent of dermatomycosis in cattle and man from different parts of the world (Domsch & al., 1980).

Trichophyton was the third most frequent fungal genus and was recovered from 55% of mud samples. It was represented by 3 species of which *T. ajelloi* was the most common; *T. terrestre* and *T. mentagrophytes* were less frequent. *T. terrestre* has a wide distribution and was recovered from different substrates from different places of the world (Todaro, 1978; Jana & al., 1979; Bojanovsky & al., 1979; Della Franca & Caretta, 1984; Mangiarotti & Caretta, 1984). The above 3 species were found as saprophytes in man and animals, but also have been recognized as the causal agent of tinea, onychomycosis and ringworm (Frey & al., 1979).

Table 1: Numbers of cases of isolation (NCI: out of 20), percentage frequency (%F) and occurrence remark (OR) of fungal genera and species recovered from 20 mud samples baited with human hair at 28°C.

Tableau 1: Genres et espèces de champignons isolés à partir de 20 échantillons de boue, en utilisant comme pièges des cheveux humains. Incubation à 28°C.

Genera and species	NCI	% F	OR
Chrysosporium	**16**	**80**	**H**
C. indicum (Rand. & Sand.) Garg.	14	70	H
C. tropicum Carmichael	9	45	M
C. keratinophilum (Frey) Carmichael	7	35	M
C. queenslandicum Apinis & Rees	5	25	L
C. pannorum (Link) Hughes	4	20	L
C. inops Carmichael	2	10	R
C. parvum Emmons & Ashburn	1	5	R
C. pannicola (Corda) V. Oorschot & Stalpers	1	5	R
C. dermatitidis Carmichael	1	5	R
Microsporum	**14**	**70**	**H**
M. boullardii Dominik & Majchrowicz	12	60	H
M. gypseum (Bodin) Guiart & Grigorakis	9	45	M
M. racemosum Borelli	3	15	L
Trichophyton	**11**	**55**	**H**
T. ajelloi (Vanbreuseghm) Ajello	8	40	M
T. terrestre Durie & Fery	3	15	L
T. mentagrophytes (Robin) Blanchard	1	5	R
Penicillium	**9**	**45**	**M**
P. funiculosum Thom	6	30	M
P. chrysogenum Thom	4	20	L
P. citrinum Thom	1	5	R
P. vinaceum Gilman & Abbott	1	5	R
P. islandicum Sopp	1	5	R
Aspergillus	**8**	**40**	**M**
A. flavus Link	6	30	M
A. sydowii Van Tieghem	3	15	L
A. fumigatus Fresenius	2	10	R
A. ochraceus Wilhelm	2	10	R
A. terreus Thom	1	5	R
A. candidus Link	1	10	R
Fusarium	**6**	**30**	**M**
F. solani (Mart.) Sacc.	3	15	L
E. equiseti (Corda) Sacc.	2	10	R
F. moniliforme Sheldon	1	5	R
Candida albicans (Robin) Guiart & Grigorakis	4	20	L
Scopulariopsis brevicaulis (Sacc.) Bainier	4	20	L
Acremonium strictum W. Gams	3	15	L
Emericella nidulans (Eidam) Vuillemin	3	15	L
Arthroderma tuberculata Kuehn	2	10	R
Allescheria boydii Shear	2	10	R
Botryotrichum piluliferum Saccardo & Marchal	2	10	R
Drechslera state of *Cochliobolus spicifer* Nelson	2	10	R
Geotrichum candidum Link	2	10	R
Myrothecium verrucaria Ditmar: Fr.	2	10	R
Cunninghamella elegans Londner	1	5	R
Eurotium chevalieri Mangin	1	5	R
Mucor pusillus Lindt	1	5	R
Paecilomyces lilacinus (Thom) Samson	1	5	R
Trichothecium roseum (Pers.) Link	1	5	R

Occurrence remark: H = high occurrence; between 11 to 20 cases (out of 20 samples). M = moderate occurrence; between 6 to 10 cases. L = low occurrence; between 3 to 5 cases. R = rare occurrence; 1 or 2 cases.

Penicillium emerged in moderate frequency of occurrence and was recovered from 45% of mud samples. It was represented by 5 species: *P. funiculosum*, *P. chrysogenum*, *P. citrinum*, *P. vinaceum* and *P. islandicum*. Abdel-Fattah & al. (1982) isolated *P. funiculosum* from Egyptian cultivated soils baited with human hair. Bagy & Abdel-Hafez (1985) isolated *P. chrysogenum*, *P. verruculosum*, *P. funiculosum* and *P. islandicum* from camel and goat hairs from Al-Arish Governorate (Egypt).

Aspergillus was encountered in 40% of mud samples. From the genus, 6 species were collected and the most common species was *A. flavus*, followed but far behind by *A. sydowii*, *A. fumigatus*, *A. ochraceus*, *A. terreus* and *A. candidus*. Abdel-Fattah & al. (1982) isolated *P. funiculosum* once from cultivated soils at Assiut Governorate baited with animal hair. The above species were also encountered, but with different frequencies, from camel and goat hairs from Al-Arish (Bagy & Abdel-Hafez, 1985).

Fusarium was recovered from 30% of the samples. Three species were collected of which *F. solani* was prevalent; *F. equiseti* and *F. moniliforme* were less frequent. Members of *Fusarim*, *Aspergillus* and *Penicillium* are common soil fungi in Egypt (Moubasher & Abdel-Hafez, 1978).

The remaining species were isolated in low or rare frequency in mud samples baited with human hair: *Candida albicans* (20%), *Scopulariopsis brevicaulis* (15%), *Acremonium strictum* (15%), *Emericella nidulans* (15%), *Arthroderma tuberculata* (10%), *Allescheria boydii* (10%), *Botryotrichum piluliferum* (10%), *Drechslera* state of *Cochliobolus spicifer* (10%), *Geotrichum candidum* (10%), *Myrothecium verrucaria* (10%), *Cunninghamella elegans* (5%), *Eurotium chevalieri* (5%), *Mucor pusillus* (5%), *Paecilomyces lilacinus* (5%) and *Trichothecium roseum* (5%). Most of the previous species were isolated from hairs of different animals in Egypt (Bagy & Abdel-Hafez, 1985; Bagy, 1986).

Present results reveal that there is no correlation between the distribution and occurrence of keratinophilic and cycloheximide resistant fungi and soil textures or site of samples. But mud samples with low levels of total soluble salts (0.1% of mud dry weight) coincided with a wide range of genera and species and vice versa; this due to most of these fungi are highly sensitive to high salinity. Abdel-Hafez & al. (1989) found that soil samples collected from salt marshes in Sinai Peninsula are free from keratinophilic fungi. Generally mud samples tested proved to be relatively rich in these fungi, probably because impact and activities of man, birds and animals (e. g. buffalo, cat, cow, donkey, dogs, goat, sheep, mice, rats, and other small mammals) on border and edge of Ibrahimia canal. Also *Candida albicans* was isolated from 4 samples (out of 20), this organism is common in soil, of world-wide distribution and mainly originated, with most other keratinophilic fungi, from animals and birds (living or dead). This species has been recognized as the causal agent of candidiasis (Frey & al., 1979).

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